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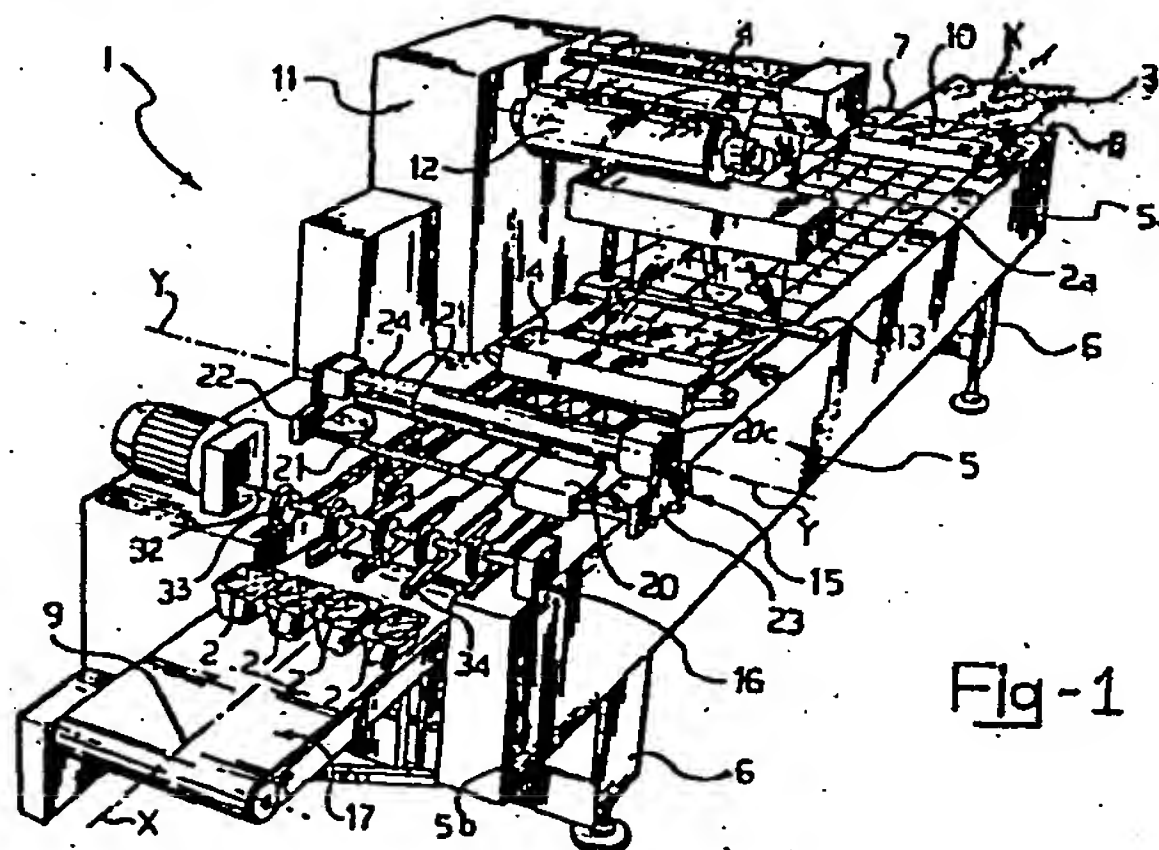
㉕ Applicant: IDEALTECNICA S.N.C. DI RE TARCISIO E C.  
Via Morgagni, 16  
I-20010 Pogliano Milanese Milan (IT)

㉖ Inventor: Re, Tarcisio  
10 Via Omero  
I-20017 RHO (Milan) (IT)

㉗ Representative: De Nova, Roberto et al  
c/o Jacobacci-Casetta & Perani S.n.c. Via Visconti di  
Modrone 7  
I-20122 Milano (IT)

㉘ A thermoforming machine for making sealed packaging trays for generic products.

㉙ A thermoforming machine (1) adapted for making sealed packaging trays for generic products from a semirigid sheet (3) and a film (4), which can perform a transverse cut through the sheet (3) and the film (4) in a reliable manner and with a very small force, comprises a frame (5) wherein a longitudinal feed path (9) is defined for the sheet (3) and the film (4), and a cutter device (15) for severing the sheet (3) and film (4) in a transverse direction having two knife dies (18) extending in a transverse direction, and a carriage (20) reciprocable along the dies (18) and provided with two rollers (25) in pressure contact relationship with the respective dies (18).



**Fig-1**

## Description

This invention relates to a thermoforming machine, adapted for making sealed tray packaging containers for generic products, of a type which comprises a frame wherein a longitudinal feed direction is defined for a semirigid sheet and a film, and a cutter device mounted on said frame to sever the sheet and/or film in a transverse direction.

As is known, thermoforming machines of the kind specified above require that a transverse cut to the feed direction be performed on the semirigid sheet, in which trays have been thermoformed, and the film which has been heat sealed to the semirigid sheet to seal off the trays.

Such machines are currently equipped with cutter devices for carrying out the severing operation, whereby the sheet and film are cut between a knife die and an anvil plate, said die and said plate being brought close to and forced against each other. This procedure, while serving basically its purpose, is found objectionable in actual practice for a number of reasons. In particular, it is found that the cut provided is not always a fully severing one, thereby the separation of the trays is not as complete and neat as desired.

In all cases, in order to press the knife die and anvil plate against each other, an actuator must be made available to develop a very large force, on the order of several tons, which is inconvenient from the standpoint of space requirements as well as of the weights and costs involved.

The problem that underlies this invention is to provide a machine of the type specified above, which has such constructional and operational features as to meet the demand noted above while overcoming the drawbacks just pointed out in connection with the background art.

This problem is solved by a machine as indicated being characterized in that said transverse cutter device comprises a transversely extending knife die, a carriage movable back and forth along the knife die, and a roller journaled on said carriage and held in rolling engagement with the die by pressure contact therewith.

Further features and the advantages of a machine according to the invention will become more clearly apparent from the following detailed description of an exemplary embodiment thereof, to be taken by way of illustration and not of limitation in conjunction with the accompanying drawing views, where:

Figure 1 is a perspective view showing a thermoforming machine according to the invention;

Figure 2 is an enlarged scale perspective view of a detail of the machine shown in Figure 1; and

Figure 3 is a sectional detail view of the machine of Figure 1.

With reference to the drawing views, the numeral 1 generally designates a thermoforming machine according to the invention, which machine is adapted to make sealed tray packaging containers, indicated

at 2, for generic products, e.g. food products, medical products, small hardware, and so forth, from a semirigid sheet 3 and a film 4.

The semirigid sheet 3, which may have a thickness dimension of of 4 tenths of a millimeter, for example, and be made of shock-resistant polyvinylchloride or polystyrene, is formed with dimples 2a constituting tray blanks.

From the film 4, which may have a thickness dimension of 5 hundredths of a millimeter, for example, and be made of polythene, a covering is formed for each dimple to result in a sealed tray.

The thermoforming machine 1 comprises a frame 5 intended to rest on the floor by means of feet 6, having an elongate shape, and including two longitudinally extending side frames 7 and 8.

Along the frame 5, and between the two side frames 7 and 8, a path 9 is defined which has a longitudinal feed direction x-x for the sheet 3 and film 4 extending from one end 5a of the frame 5, whereat the sheet 3 is fed in, and an opposing end 5b of the frame 5, whereat the finished trays 2 are delivered.

The machine 1 comprises, in addition to conventional mechanisms for feeding the sheet 3 stepwise along the path 9, a plurality of devices, distributed along the frame 5, which are active on the sheet 3 and/or film 4 and described hereinafter.

A thermoforming device 10 is provided at the end 5a which is carried on the frame 5 and bridges the gap between the side frames 7 and 8. The device 10 is active on the sheet 3 to form a crosswise array of dimples, e.g. with four dimples per array, in the width direction of the sheet, at each stepwise advance movement of the sheet.

Downstream of the thermoforming device 10, there is provided a feeder device 11 for feeding forward the film 4 from a coil 12, over idler deflector rollers to a roller 13 whence the film 4 is coupled with the sheet 3 top and travels along with it in the x-x direction of the path 9 toward the end 5b of the frame.

It should be noted that, between the device 10 and the device 11, there is provided a station, not shown in the drawing views, whereat each dimple 2a is filled with a product as the occasion may be in an automatic manner, e.g. by means of suitable dispensing and metering arms or hoppers, or alternatively in a manual manner by specially appointed operators.

Arranged downstream of the film feeder device 11 is a heat sealing device 14 which is supported on the frame 5 and bridges the gap between the side frames 7 and 8. The heat sealing device 14 is active on the sheet 3 and the film 4 to first create a vacuum around the food product in the dimple 2a, and then heat seal the film 4 to the sheet 3.

Downstream of the heat sealing device 14 there are arranged in succession a cutter device 15 for severing the sheet 3 and film 4 transversely between dimple arrays, and a cutter device 16 for severing the

sheet 3 and film 4 longitudinally between dimple rows.

Finally, downstream of the cutter device 16, at the end 5b of the frame 5, a conveyor carpet 17 is provided onto which finished trays 2 are laid.

Advantageously, the cutter device 15 for cutting across the sheet 3 and film 4 comprises two knife dies, both indicated at 18, which extend transversely along a perpendicular y-y direction to the x-x direction between the two side frames 7 and 8. The two dies 18 are attached rigidly to a die holder plate 19. The die holder plate 19 is guided movingly in the frame 5 between the side frames 7 and 8 of an up and down motion under the action of a drive means, known per se and not shown, such as a pair of air-operated cylinders, between a raised working position whereat the knife dies 18 are interposed to two arrays of dimples 2a, and an inoperative position whereat they are brought down and away.

It should be noted that with the knife dies 18 at their working positions, they have their cutting edge, indicated at 18a, located exactly adjacent the sheet 3.

The cutter device 15 also comprises a carriage 20 which is movable back and forth, under the action of a drive means 20c, along and above the knife dies 18 in the y-y direction. In particular, the carriage 20 is supported on two guide bars 21 lying bridge-fashion across the path 9 and secured to opposing heads 22 and 23 which are bolted on the side frames 7 and 8, respectively. The drive means 20c for reciprocating the carriage 20 consists of an air-operated cylinder 24 whose heads are attached to the heads 22 and 23.

The cylinder 24 is advantageously of the so-called rodless type. The stroke length of the carriage 20 between the stroke end positions, indicated in the drawing at 20a and 20b, is selected to barely exceed the length of the knife dies 18.

The cylinder 20 is sized to provide an adequate low travel speed for the carriage, e.g. of approximately 4 meters per minute.

Mounted on the carriage 20 are two idler rollers 25, journaled for rotation about an axis a-a extending parallel to the axis x-x. each roller 25 is held in rolling engagement, by pressure contact at a preset level, with a respective knife die 18.

More specifically, each roller 25 is mounted for free rotation around a pin 26 lying along the axis a-a and being carried on a respective lever arm 27 on a middle portion 28 of the arm.

Each lever arm 28 is pivoted, at one end 27a thereof, on a pin 29 mounted on the carriage and having an axis b-b which lies parallel to the axis x-x.

Thus, each generatrix line of the roller 25 will be perpendicular to the cutting edge 18a of its respective die 18.

Active on the opposing end 27b of the lever arm 27 is a pressure means 30, such as an air-operated minicylinder, which is mounted on the carriage 20 and urges the lever arm 27 against the bias force of an elastic means 31 comprising a return spring, for example.

The minicylinder 30 loads the lever arm 27 downwards, and accordingly, urges the roller 25 into pressure contact against a respective die 18.

The pressure contact exerted by the roller on the die, at the intersect point P of a roller generatrix line with the die cutting edge, has a preset desired force which is adjustable within a range of low values, e.g. of 50 kg, by varying the delivery pressure of air to the air-operated minicylinder 30.

The amount of said force can be advantageously read, e.g. by means of a pressure gauge placed in the air delivery line to the minicylinder and having a suitable scale graduated to display the force.

The longitudinal cutter device 16 comprises an electrically operated chuck 32 bridging the gap between the side frames 7 and 8 and provided with rotary blades 33 which engage with respective stationary anvil blades 34 supported on the frame 5.

In operation, the machine of this invention will deliver four trays at each forward step of the sheet 3.

During the sheet standstill between forward steps, there become operative the thermoforming device 10, which will form a set of four dimples, the product loading station, the heat sealing device 14, and the transverse cutter device 15. During the stepwise forward movement, on the other hand, the feeder device 11 for the film 4 and the longitudinal cutter device 16 are operative.

Note should be taken in particular of that in the transverse cutter device 15 the carriage 20 is operated to reciprocate during the sheet 3 standstills. More specifically, the carriage 20 will complete forward and backward strokes which are both working strokes, from the position 20a to the position 20b, and vice versa, during consecutive standstills of the sheet 3.

During the stroke movement of the carriage 20, the roller 25 will roll along the cutting edge 18a of its respective die 18, thereby the intersect point P of a generatrix line of the roller with the cutting edge will run along the cutting edge to provide a desired cut across the entire length of the die. Since the contact between the roller and the die is substantially punctiform, a high pressure is easily produced at that point on the sheet to be severed, even if the forces applied to the roller may be comparatively small.

The principal advantage of the machine according to the invention resides in the unusual effectiveness of the transverse cutting action applied to the sheet over the entire length of the die, in a thorough and reliable manner.

A further advantage is that it is simple construction-wise and has a lightweight low-cost structure by virtue of the transverse cut bringing into play very small forces and relatively low operating rates. The carriage stroke is, in fact, completed during the standstill between stepwise forward movements at overlapping times with the dimple thermoforming and product loading processes, which enhances a clean cut through the sheet.

It should be added that reliable long-term operation features are to be expected of the inventive machine and no need for costly maintenance and repair.

It stands to reason that the machine described in the foregoing may be variously altered and modified by a skilled person in the art, in order to meet



specific and contingent demands, without departing from the true scope of the invention as set forth in the appended claims.

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#### Claims

1. A thermoforming machine (1), adapted for making sealed tray packaging containers for generic products, of a type comprising a frame (5) wherein a longitudinal feed direction is defined for a semirigid sheet (3) and a film (4), and a cutter device (15) mounted on said frame (5) to sever the sheet (3) and/or film (4) in a transverse direction, characterized in that said transverse cutter device (15) comprises a transversely extending knife die (18), a carriage (20) movable back and forth along the knife die (18), and a roller (25) journaled on said carriage (20) and held in rolling engagement with the die (18) by pressure contact therewith.

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2. A thermoforming machine according to Claim 1, characterized in that said roller (25) is mounted for free rotation on a lever arm (27) pivoted on the carriage (20), and that said roller (25) is held in pressure contact with the knife die (18) by an air-operated minicylinder (30) active on the arm (27) against the bias force of an elastic means (31).

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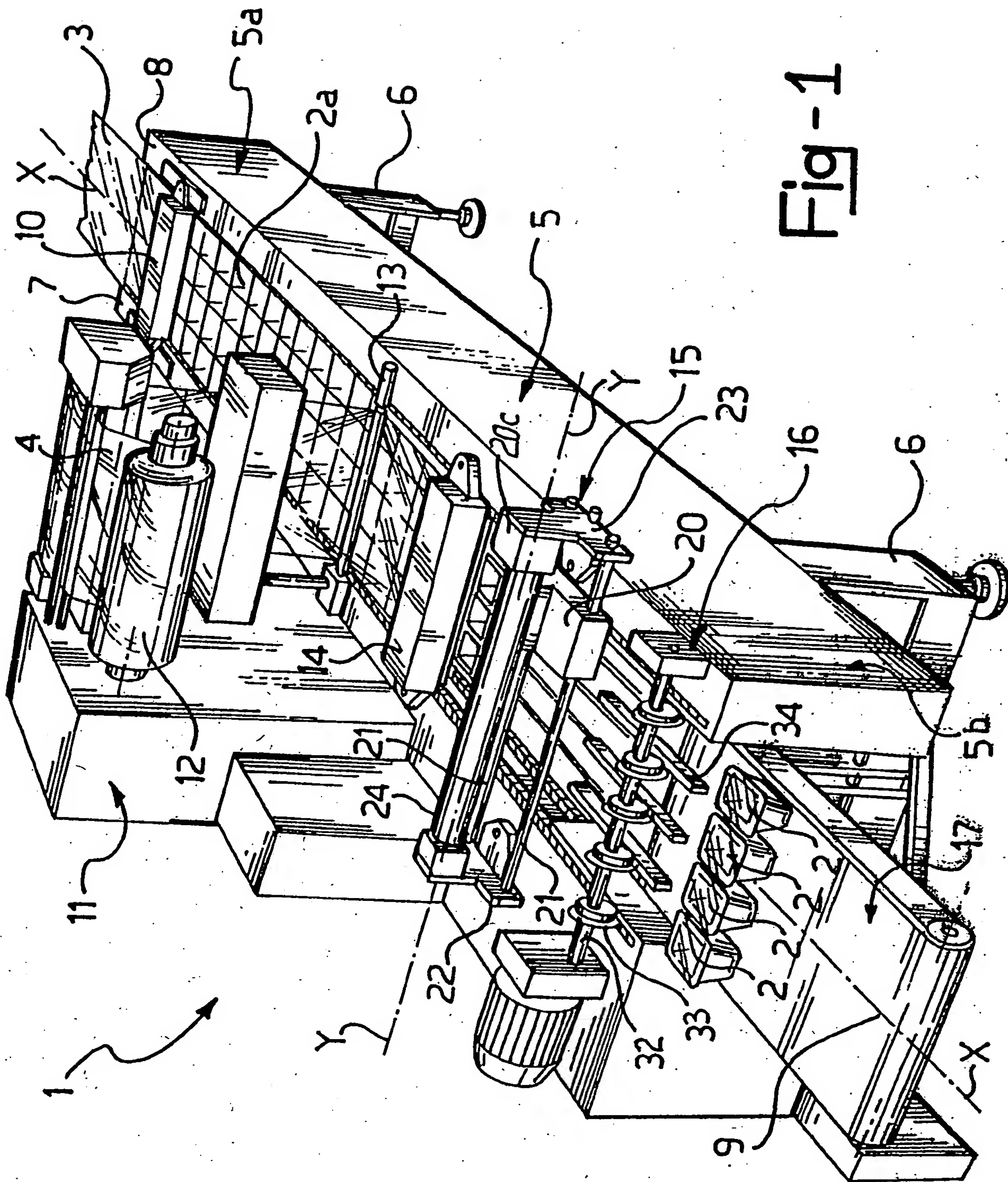
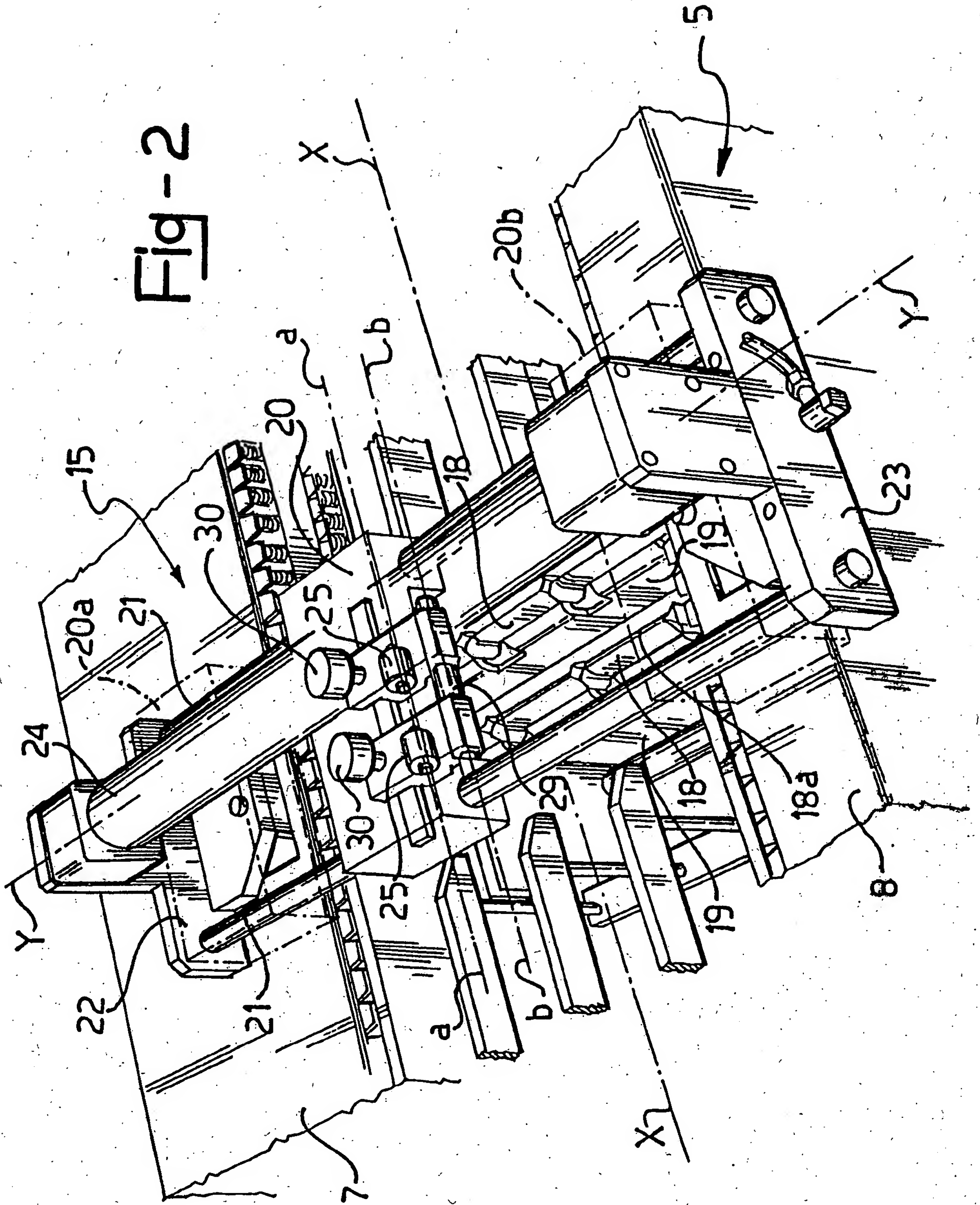


Fig-2



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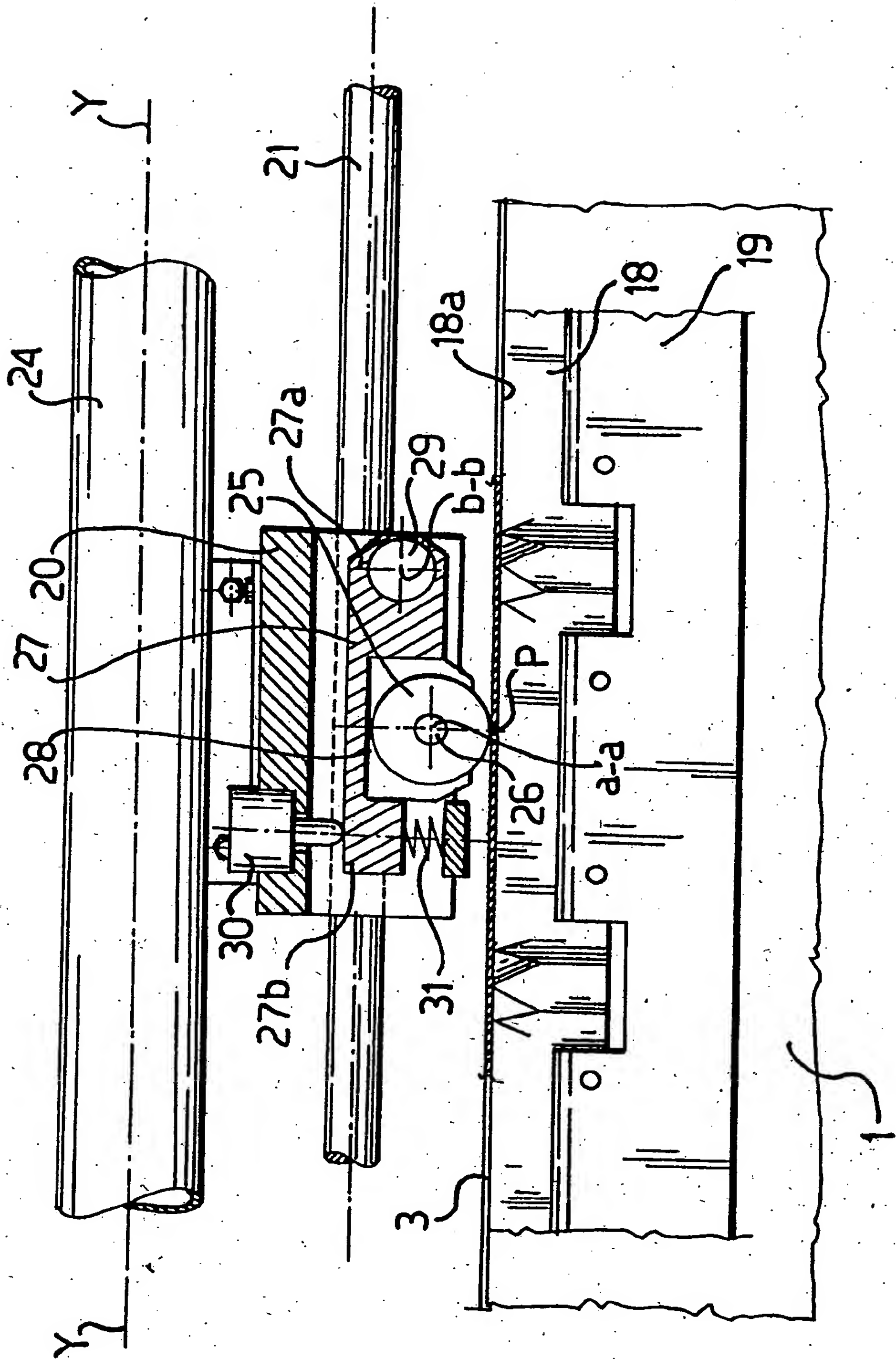


Fig-3



European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number

EP 88 83 0038

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
Y	US-A-3 759 122 (LANE) * Abstract; column 5, line 54 - column 6, line 30; figures 1,7-9 *	1	B 65 B 61/06
Y	PATENT ABSTRACTS OF JAPAN, vol. 8, no. 220 (M-330)[1657], 6th October 1984; & JP-A-59 103 719 (ANZAI KASEI KOGYO K.K.) 15-06-1984 * Whole abstract *	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
			B 65 B B 26 F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 17-05-1988	Examiner CLAEYS H.C.M.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	